# Water Management

**Purpose:** To analyze how communities deal with water shortages, distribution, and quality in designing a long-term water use plan.

**Summary:** In this exercise, students will be assigned roles as community members, develop questions and positions, and participate in a mock "community meeting" to discuss the development of a water use plan that addresses water shortages, distribution, and water quality.

**Background:** Utah is the second driest state in the nation, yet has the second highest per capita water use in the nation. These seemingly contradictory facts are a result of our extensive system of storage and distribution of irrigation water – snowmelt that is trapped and used throughout the growing season. Utah also has a very high growth rate, primarily in urban areas. As our population increases, many water related issues will need to be addressed: How will water that has been used traditionally for agriculture be used in the future? How will the water needs of urban populations be met? Is there a need to build more water reservoirs and is the public willing to pay that cost? How does water conservation fit into this picture? You may want to check with your local Extension or city offices to obtain more detailed information for your area.

For more information on water use, planning and water law in Utah, see:

- http://www.westernwaterlaw.com/Utah.htm
- http://ceed.wsu.edu/resources/environmental_law/west_water_law.html - Western Water Law
- http://www.water.utah.gov/ - Utah Division of Water Resources
- http://nrwrt1.nr.state.ut.us/ - Utah Division of Water Rights
- http://www.drinkingwater.utah.gov/ - Utah Division of Drinking Water

Duration:
Variable

Setting:
Classroom

Link to the Utah Core Curriculum:
Earth Systems – 9th grade
Standard IV-1e

ILO's:
1 f, j
2 a, c-f
3 a, c
4 a-e
5 a
6 a-d, g-i

- http://www.waterquality.utah.gov/ - Utah Division of Water Quality
- http://www.epa.gov/owow/watershed/ - EPA Watershed Management
- The Utah Stream Team Manual's Water Pollution and Water Regulations Sections

**Materials:** Access to the internet and background resources listed above.

**Classroom Activity:**

1. Ask the students to provide examples of different water uses occurring in their community. Make a list of these uses on the board. For a complete breakdown of public water use (residential, industrial, institutional, and commercial), and a breakdown of water use in the home, see the Teacher Resource pages provided.

2. Ask the students to tell you what kind of decisions need to be made about water use and distribution and about protecting water quality. Ask them how these decisions are made. Refer to the timeline of Utah's role in water management and planning since statehood in the Teacher Resource pages.

3. Discuss with the students the importance of public input when developing water use plans.

4. Tell the students that they will be assigned different roles and participate in a "mock" community meeting to give their input on a water use plan focusing on water shortages, distribution and water quality. Divide the students into groups and assign them roles found on the Teacher Resource pages.

5. Tell the students that during the mock town meeting, they will need to discuss their role in the community as it relates to water shortages, distribution and water quality. How will a change in one of these issues affect them? What are the issues they would like to see covered in a water plan?

6. To help this activity run smoothly, assign a student to be the meeting facilitator. Before the meeting, they should develop a list of questions and concerns to be addressed by the group. Alternatively, this role can be played by the teacher. The students will also need to create rules and guidelines for the format of the meeting as a class.

7. If you are limited in time, you may need to let the students come up with their positions and needs quickly in class, and have the "meeting" on the same day. To give the debate a little more context, have the students research their positions further as an assignment and hold the "community meeting" another day.

**NOTE:** You may want to share the following resources with your students as they are formulating their concerns and needs. These are included in the Teacher Resource pages.

- The guidelines the Utah State Water Plan uses when developing documents
- Present and Projected Total Municipal and Industrial Water Use by Basin
- Water Prices of Various Western Cities
- Typical Water Use Within the Home
- Population Trend and Projection
- Per Capita Use of Public Water Supplies in the United States

**ACTIVITY EXTENSIONS:**

- Interview a local politician or community decision maker about the water use plan.

  (Utah agencies involved in water decisions include the Divisions of Water Resources, Water Rights, Wildlife Resources, Drinking Water and Water Quality. Other entities include county and city governments and planning offices, irrigation companies and water conservancy districts).

## Applying the Data:

- After the "meeting," have the students write a brief summary of the arguments presented.
- Ask the students how they would decide to allocate limited water.

# Water Management

Further Discussion:

**1. Define western water law and discuss the role it has played in determining how water can be allocated in Utah.**

*In states governed by western water law, water may not be removed from a source unless the user has a "water right" to that water. Water rights are owned and sold separately from the land itself. "First in time, first in right" (the doctrine of prior appropriation) is a central theme of western water law. Water is allocated based on seniority of the water right. In times of drought, when water is scarce, the oldest or most "senior" rights will receive their allocations before less senior water right owners.*

*Water rights are tightly regulated, providing for the diversion of specific amounts of water, from a specific point, for a specific use, over a specific amounts of time. Under current western law, water rights can be issued to anyone who is putting the water to a "beneficial use."*

*Water must be used or the right to it may be lost. Recent changes in Utah law allow water owners to transfer their rights to the Utah Division of Parks or Wildlife Resources. This water can then remain in the stream to provide the beneficial use of aquatic habitat.*

**2. Discuss culinary water sources vs. irrigation water (secondary water) sources. How do these differ? What water quality considerations are there for both types of water?**

*There is no single definition of "clean water" used in water quality. Instead, the Department of Water Quality has determined the "designated beneficial uses" for each water body in the state and has determined the quality of water necessary to maintain those uses (see table on the next page). The level of protection varies according to the designated use. For example, drinking water sources must be free of many contaminants, while salts are the main contaminant of concern for irrigation water.*

*All waters of the state that do not meet their "designated uses" require a watershed protection plan. Water used for culinary purposes (e.g. Big Cottonwood Canyon) requires a separate source water protection plan. For example, dogs are not allowed up Big Cottonwood Canyon in Salt Lake City because the water coming from this area is used for drinking water. This is an example of regulation that is enforced for drinking water sources, but would not be an issue for agricultural water sources.*

**Beneficial uses of water (partial list)**

Class 1 – Drinking water designations
- 1C – Domestic purposes with prior treatment (drinking water)

Class 2 – Protected for recreation and aesthetics
- 2A – Primary contact for recreation (swimming)
- 2B – Secondary contact for recreation

Class 3 – Protected for aquatic wildlife
- 3A – Coldwater species of game fish and other aquatic life
- 3B – Warmwater species of game fish and other aquatic life
- 3C – Nongame fish and other aquatic life
- 3D – Waterfowl, shore birds and other water oriented wildlife

Class 4 – Protected for agriculture uses (irrigation and stock watering)

Class 5 – Protected for the Great Salt Lake only (primary and secondary contact recreation, aquatic wildlife and mineral extraction)

**3. Discuss conservation versus new water development. Discuss the table on the Teacher Resource page of costs/1000 gallons in different cities. Do you think that the price of water is a "tool" for encouraging conservation practices? What other approaches might work?**

- *"Rewards" for conservation (e.g., lower prices for users who consume under a certain level of gallons per month).*
- *Penalties for exceeding a certain level of water use per month.*
- *More education on the need for water conservation.*
- *Different prices for water used for different purposes (e.g., irrigation water is subsidized).*

# Community Roles

| ROLE | CONCERN |
|---|---|
| Farmer | Uses flood irrigation practices and water for livestock. |
| Homeowner | Uses water for garden, lawn, household. |
| Golf course | Uses water for golf greens. |
| Industry | Uses water for production. |
| Tax payers | Concerned about tax increase. |
| Local conservancy group | Concerned with water pollution issues. |
| Local business owner | Concerned about taxes, may also be concerned about limits on growth. |
| Electric company | Needs water for power generation. |
| Water district | Supplies local drinking water. |
| Fishing group (e.g., Trout Unlimited) | Concerned about water in streams for fish habitat. |
| Whitewater recreation group (e.g., kayaking group) | Want high flows left in river to restore/maintain good kayaking. |
| State agency decision makers | Division of Water Resources is required by law to provide water. Division of Water Quality is required by law to protect water quality. |

# History of Water Management in Utah

**The following list chronicles the gradual evolution of Utah's role in water resources planning and management since statehood.**

• 1897 The office of the State Engineer (later renamed the Division of Water Rights) was established to oversee water appropriations.

• 1903 The Water Code became part of Utah law and The Doctrines of Prior Appropriation and "Beneficial Use" were officially adopted.

• 1921 The Utah Water Storage Commission was created to oversee important water developments and obtain the necessary water rights.

• 1935 Groundwater was added to the state's water code.

• 1947 The Utah Water and Power Board was created to continue the mission of the Utah Water Storage Commission, which was discontinued in 1941.

• 1953 Specific legislation was passed directing the Water and Power Board to develop a state water plan.

• 1963 The Bureau of Water Pollution Control was created.

• 1967 The Water and Power Board was renamed the Board of Water Resources, and the Division of Water Resources was created.

• 1979 The Bureau of Drinking Water and Sanitation was created.

• 1991 The Department of Environmental Quality was created. As part of this department, the Division of Drinking Water and the Division of Water Quality were formed, replacing the Bureau of Drinking Water and Sanitation and the Bureau of Water Pollution and Control.

Source: Utah State Water Plan: Planning for the Future
http://www.water.utah.gov/waterplan/

# Guidelines for State Water Plans

**Utah State Water Plans use the following guidelines when developing documents.**

1. All waters, whether surface or subsurface, are held in trust by the state as public property and their use is subject to rights administered by the State Engineer.

2. Water rights owners are entitled to transfer their rights under free market conditions. Any change in place or nature of use is subject to approval by the State Engineer.

3. The state of Utah's role is to set policy, provide assistance and protect statewide water resource interests.

4. The responsibility for making many local decisions regarding water resources resides with local leaders.

5. Educating the public on water resources issues and seeking their input in the decision-making process is vital to effective planning, management and development.

6. Long-term water planning will help ensure sufficient water supplies needed for Utah's growing population.

7. Local, state and federal water resources planning and management activities should be coordinated to effect cooperation and minimize duplication.

8. The maintenance of water quality within the state's water quality standards will help sustain all present and future uses of Utah's water resources.

9. Water conservation and efficient management of existing water supplies are needed to help satisfy future water demands in the most economical and timely fashion.

10. Water development, based on sound engineering, economic and environmental principles, will help meet future water needs.

11. Recreation, aesthetic and environmental uses of water should be included in water planning, management and development activities.

Source: Utah State Water Plan: Planning for the Future
http://www.water.utah.gov/waterplan/

# Water Usage and Cost

| Present and Projected Total Municipal & Industrial Water Use by Basin | | | |
|---|---|---|---|
| Basin | (acre-feet / yr) | | |
| | Present* | 2020† | 2050† |
| Jordan River | 332,000 | 449,000 | 650,000 |
| Weber River | 170,000 | 267,000 | 358,000 |
| Utah Lake | 134,000 | 207,000 | 338,000 |
| Bear River | 50,000 | 71,000 | 103,000 |
| West Colorado River | 51,000 | 55,000 | 62,000 |
| Sevier River | 48,000 | 55,000 | 64,000 |
| Kanab Creek/ Virgin River | 42,000 | 86,000 | 183,000 |
| West Desert | 24,000 | 35,000 | 53,000 |
| Uintah | 24,000 | 27,000 | 31,000 |
| Cedar/Beaver | 20,000 | 33,000 | 51,000 |
| Southeast Colorado River | 9,000 | 10,000 | 12,000 |
| **TOTAL** | **904,000** | **1,320,000** | **1,950,000** |

| Water Prices of Various Western Cities | |
|---|---|
| City | Estimated Cost per 1,000 gallons |
| Reno | $3.39 |
| Seattle | $2.30 |
| Los Angeles | $2.22 |
| Park City, UT | $2.20 |
| Tucson | $1.81 |
| Boise | $1.68 |
| Las Vegas | $1.65 |
| Phoenix | $1.61 |
| Albuquerque | $1.41 |
| Denver | $1.14 |
| Sandy, UT | $0.99 |
| Salt Lake City | $0.87 |
| Provo, UT | $0.75 |
| Sacramento | $0.75 |
| AVERAGE | $1.63 |
| Utah Average | $1.15 |
| National Average | $1.96 |

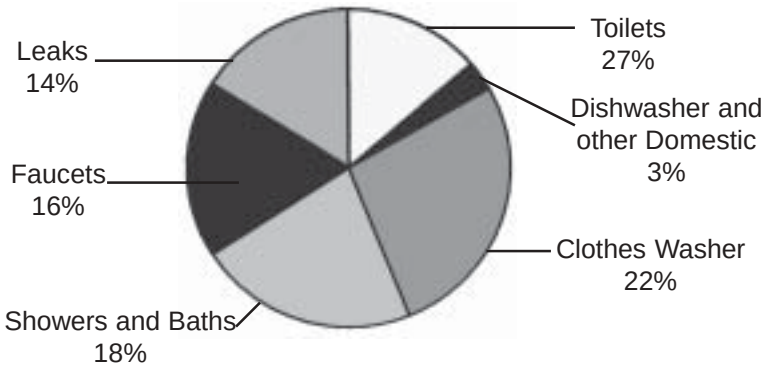
Source: Utah State Water Plan: Planning for the Future
http://www.water.utah.gov/waterplan/

# Typical Water Use Within the Home

The typical U.S. residence consumes about 69 gallons per person per day inside the home. This is approximately equivalent to one completely full bathtub. Utah is the second driest state in the nation, but typical Utah residents consume 293 gallons per person per day, 214 more gallons per person than the U.S. average. As indicated by the accompanying chart, approximately 27 percent of all the water used indoors goes down the toilet. The clothes washer uses another 22 percent for a total of nearly 50 percent of indoor water use from just two household appliances. Showers and baths consume about 18 percent and faucets another 16 percent. Leaks account for a significant 14 percent.

Surprisingly, only 3 percent of water used indoors is used by the dishwasher or other domestic purposes such as cooking and cleaning. Despite this fact, 100 percent of water supplied inside the home must meet stringent drinking water standards. The American Water Works Association (AWWA) estimates that a comprehensive program to install water efficient plumbing fixtures within the home and fix leaks could reduce total indoor water consumption by as much as 30 percent.

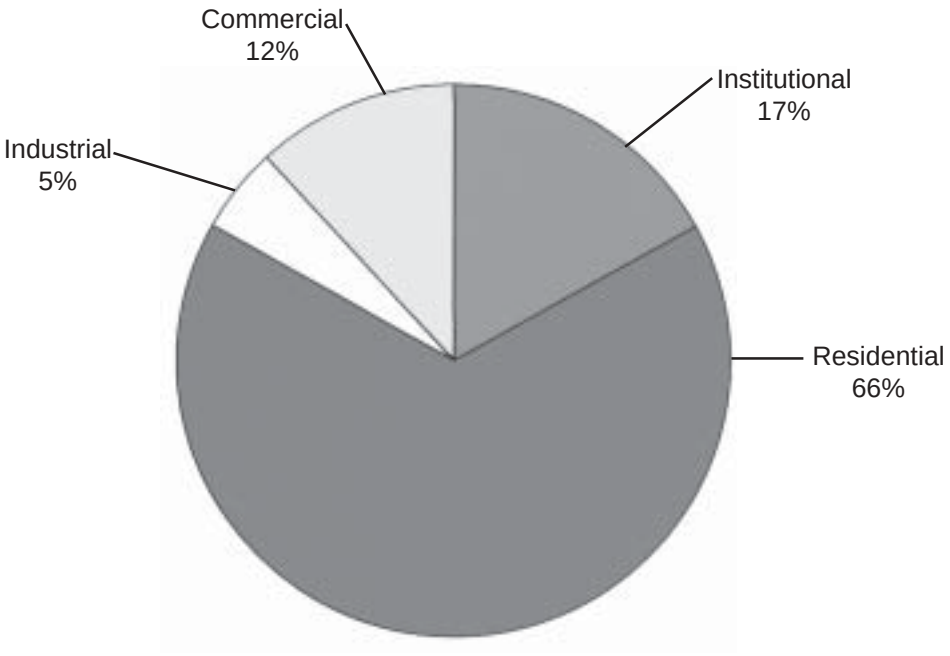
**Residential Water Use**




Source: Mayer, Peter W. et al., Residential End Uses of Water [AWWA Research Foundation, 1999], xxvi

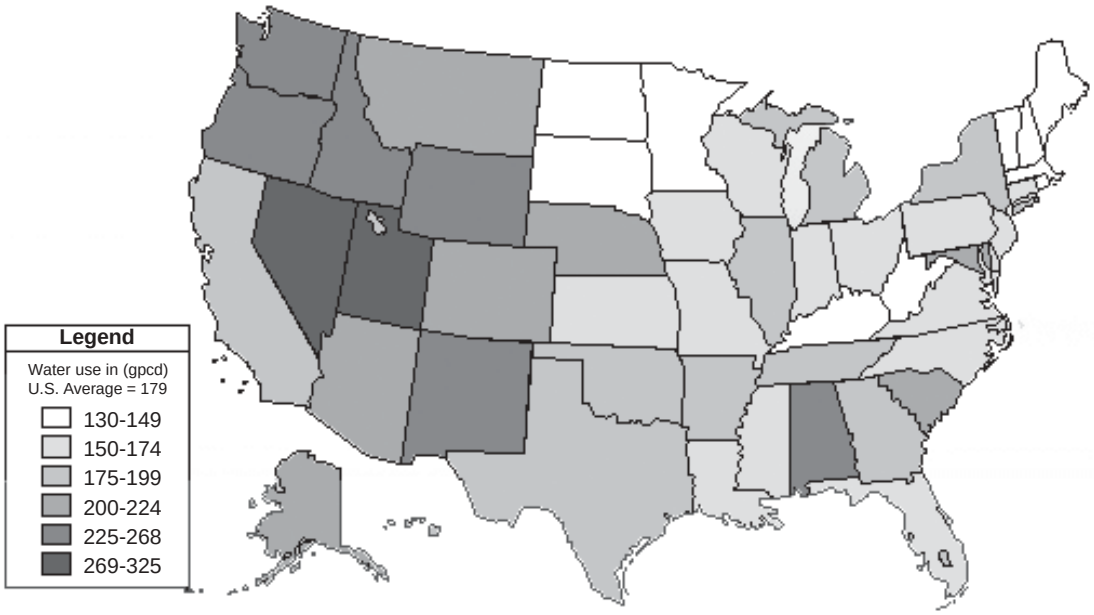
# Water Use Facts

## Breakdown of Public Supply Water Use




Source: Division of Water Resources. Municipal and Industrial Water Supply and Uses. 2000

## Per Capita Water Use of Public Water Supplies in the United States




Source: USGS, Estimated Use of Water in the United States in 1995.